EXPLORING BAMBOO

Senior Honors Project

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ABSTRACT

A summary of studies on bamboo in the form of research, ideas, and building projects. In a photographic journal format with personal remarks on projects and discoveries.

Kayla Gentry

IAR 427-01: Problems in Interior Architecture

Personal Interest:

During my freshman year in the Interior Architecture Program at UNCG we had a class in which we focused on our dreams and future career goals. I have always been passionate about sustainability and unconventional building methods and during this class I discovered a TED Talk by Elora Hardy. She is an Architect in Indonesia and has a firm called Ibuku dedicated to building with bamboo. After watching this TED Talk and hearing about the wonders of bamboo and its building properties I was hooked and have been researching it ever since.

Background Information:

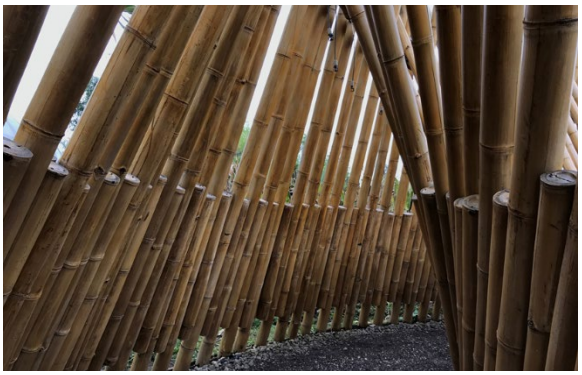
To understand bamboo's sustainable impact as a building material, it is helpful to compare it to wood and lumber, a more familiar building material. Bamboo is not like a tree but is like a grass and when it is cut down it does not die, but instead regrows. Therefore, harvesting bamboo is much different than trees and problems like deforestation can be avoided altogether with good harvesting strategies. The absolute youngest a tree can be ready to harvest for building is 30 years, and bamboo can be harvested after 7. Therefore, it is a rapidly renewable resource and sequesters loads of carbon as well.

It grows naturally in tropical environments specifically around the equator where there is plenty of sun. In these regions bamboo structures from the past are mostly gone because of bug and water damage. We now have sustainable methods for treating bamboo and can avoid these problems but stereotypes about bamboo structures being a symbol of poverty still remain in some areas.

This is changing and bamboo is being used to promote economic growth, rebuild cities and homes after natural disasters, and promote biodiversity in ecosystems all around the globe.

Bamboo building from Elora Hardy's TED Talk

Bamboo pavilion with filmy screens overhead



Bamboo structure in the Quito Botanical Garden

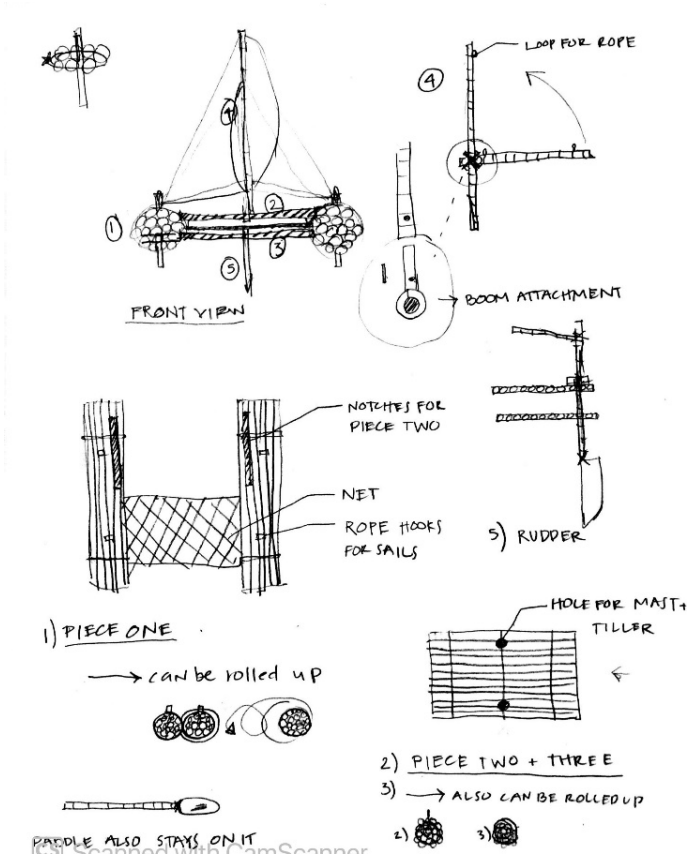
Slide from one of my materials presentations

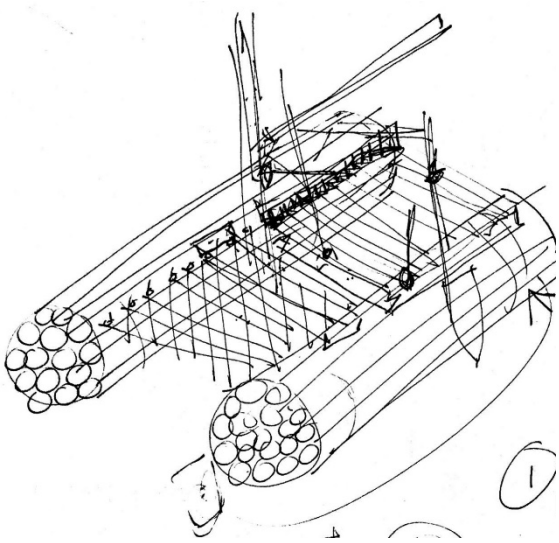
Initial Plan:

I began the semester with the intention of building a sailboat out of bamboo. I have included sketches and images of those plans to the right but as the semester went on, I began to understand the material more thoroughly and challenges arose that resulted in a shift for the final project. Specifically, there were issues with transportation because of the size that this project would have had to have be to function properly.

I have included this part of the project because the research and ideas that began here led me to the final product. The drawings show a netted catamaran style boat which was translated into the final project in the form of a hammock bench.

The images on this page show sketches of the boat I was originally planning to construct and its connection pieces, small scale models with skewers to try different layouts, and an image from a book I was reading about different boat design and bamboo structures





Gathering Materials:

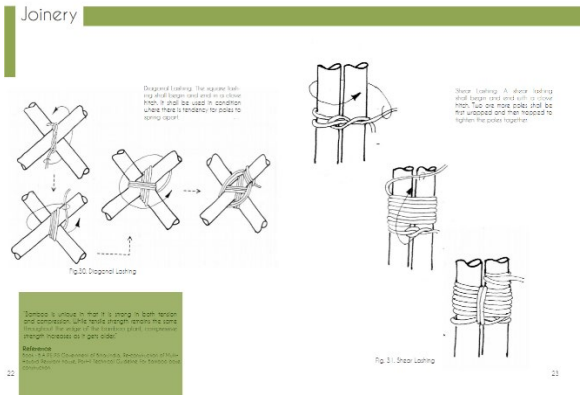
I gathered bamboo twice during the semester. First at a bamboo forest near Lake Brandt and second at a small bamboo patch near the Friendly Center at the Bog Gardens. We used gloves, a wood saw, garden clippers and a Chinese saw. We tried to cut the bamboo at an angle to ensure that it would grow back properly and utilized fallen pieces that were down after the storm to minimize impacts on the local environment.

As a material, bamboo is very lightweight and has many different chambers called stem cavities. It is stronger than steel in tensile strength, buoyant and flexible. It was interesting to see how the bamboo stalks changed over time. They became paler, and yellowed in the sun.

Lashing:

One of the first things I did to study the material was try different lashing techniques. This is a common and traditional way to join bamboo and was interesting to study.

The images on this page show the different locations and ways the bamboo was gathered and transported and the tools that were utilized in trying different lashing techniques.



Project 1: Shade for a Desk

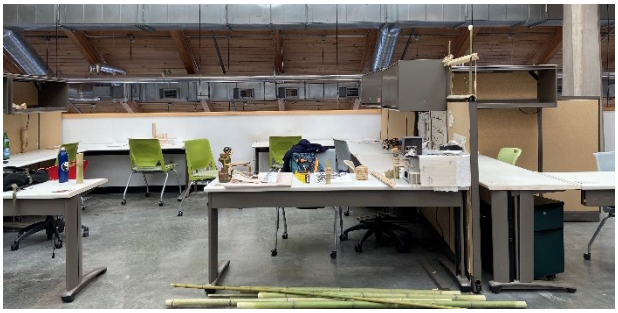
To begin exploring building with bamboo I created a structure to go over my desk in studio. There are very harsh lights directly above us that create a glare on our computer screens and this project was a fun addition to my desk that created a practical solution to a problem we all deal with on the fourth floor.

In this stage of the project the bamboo was split with a mallet and chisel. To create half pieces of bamboo and slivers for the top structure. The insides were carved out with a Dremel to create a flat surface to attach to the desk and holes were drilled with a drill. Other important tools used were sandpaper, a vice, and a Chinese saw.

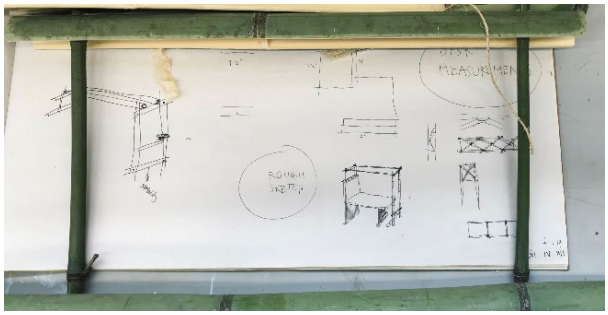
The main bamboo poles were sanded and cut to be as flat as possible and even stood up on their own! The shade panels overhead were large pieces of newsprint paper and resemble the pavilion I saw in Ecuador located on the first page. It also resembles the studio ceiling and fit in quite well.

Images on this page show the process and tools used in creating this structure, and their final applications

Project 1: Continued in Photos



Desk before shade structure was built



Notes and sketches to measure proper dimensions

Desk after shade structure was built

Detail corner shot of rope tying and joinery attempt

Photo of me to show scale and the shade that the structure provides

Detail corner shot of the other side showing the way the existing structure was used in the design

Final Project: Bamboo Hammock Bench

The first step in creating this hammock bench was to repurpose a hammock I already had. The ends were cut and then secured to two bamboo poles by drilling holes and tying knots. This process is shown in the first two images.

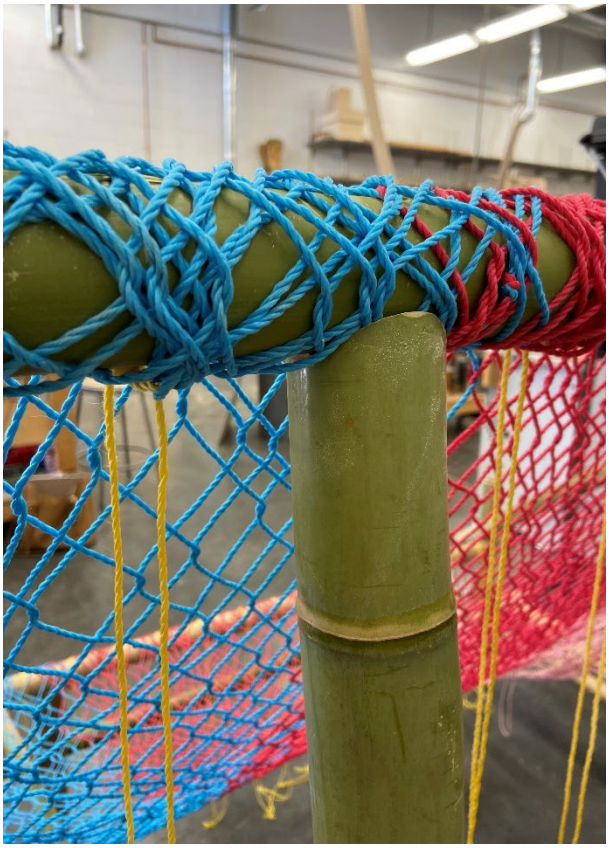
Then these two poles were placed on saw horses to create the right width for the bench. Then the next supporting poles were added to create the main rectangular structure. The technique used to secure these two pieces is shown next. We cut pieces of plywood and placed it in the ends of the bamboo chambers to connect with a screw. This helped create support on the main points of contact while also remaining out of sight.

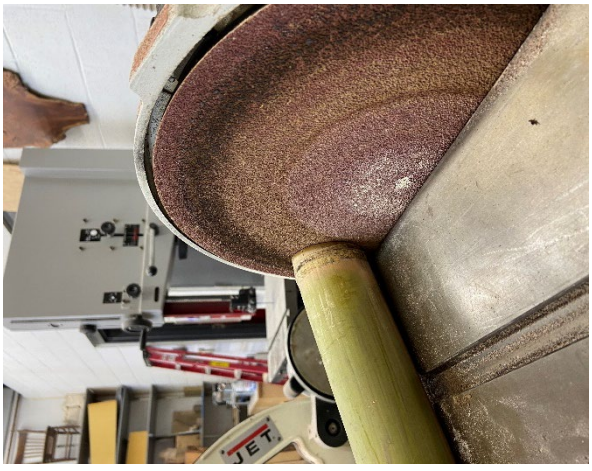
Then the poles were propped up against a wall with two chairs to determine the proper height and the vertical pieces were added. Initially, zip ties and staples were used in addition to the screws to help stabilize the structure but as the project went on other methods were tested as well.

Final Project Continued:

A bottom rectangle was added for support and then tested. The structure was still not stable enough to be sat in and another vertical piece was added to the front and the back. These pieces were carved out on the orbital and spindle sander and fit into the structure better making it much more stable. The front piece was also sanded at an angle to better distribute the weight that will be applied to the bench. After the front and back vertical pieces were added two smaller poles of bamboo were zip tied to connect them and provide extra support.

These images show the process described here

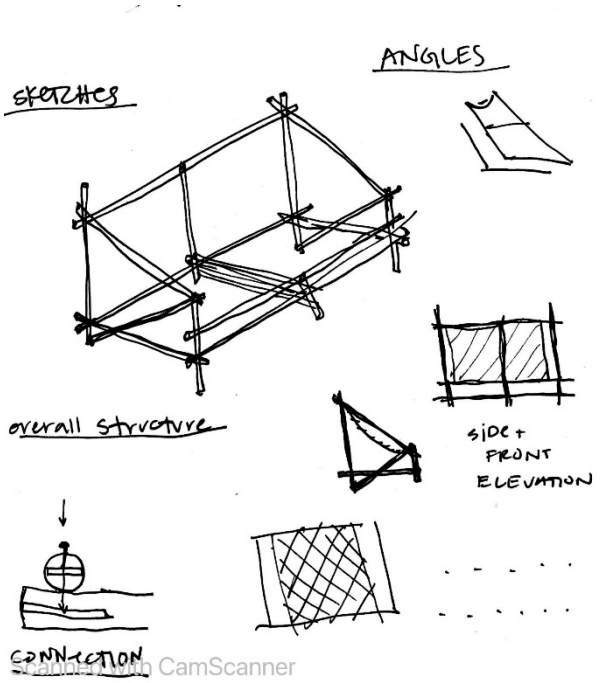




Final Project Continued:

The final structural pieces added were two diagonal pieces on the corners and another piece connecting the middle front and back vertical pieces. After these additions the structure is now very stable and seen below are two studio friends testing it out.

The final touches were braiding the hanging strings, wrapping the connection points with a burlap fabric to provide extra support and cover the zip tie connections, and finally spraying the structure with a lacquer that protects it from rain and makes it able to be placed outside. There are a few other possible finishing touches such as adding a shade structure with the back two tall poles being the base, and adding in more webbing to the hammock.



Closing Remarks:

Working with this material provided many challenges due to its round nature and the varying sizes of poles we were working with. There are many things that could be done differently in the future to make this piece even more structurally sound and aesthetically clean but I love these structures as my first main attempts in building with bamboo. The way that the process is so clearly seen on the bench through the zip ties and remaining drill holes and marks are special and really show the growth and discovery that occurred while creating this structure. It was amazing to be able to explore something I am so passionate about and plan to continue studying and working with in grad school and beyond.

I want to conclude by thanking all of the people I could not have done this without. First of all, my professor Sebastian Lindquist who taught me so much this semester and helped me all along the way. My friends who helped me cut bamboo down, transport it and brainstorm all the possible things I could make this semester. And my family who is always supportive of my ideas and helped me transport the final project. And lastly of course, the ultimate creator who inspires and guides me every day through His Son, The Lord God Himself.

Finished Photo of the Bamboo Hammock Bench